

REMARKS

Reconsideration of the subject application is requested in view of the foregoing amendments and the following remarks.

Applicant appreciates the search performed by the examiner during substantive examination of the subject claims.

The amendments to the specification are to correct readily discernible errors. No new matter is submitted.

Claims 1-22 are pending. In this paper, no claims are amended.

The status of claims 3 and 13 as being free of the prior art of record is noted with thanks.

Claims 1-2, 4-12, and 14-18 stand rejected for alleged obviousness from Nakasaji '837 in view of Suzuki '709. This rejection is traversed.

The instant claims address the following problem (see specification, page 4, lines 6-21):

Whenever a reticle is irradiated with a charged particle beam, heat is generated by interaction of the irradiating charged particles of the beam with the material of the reticle. This heat can accumulate in the reticle and cause thermal deformation and distortion of the reticle. Various techniques have been devised for reducing absorption of a charged particle beam by the reticle. One technique is to configure the pattern-defining portions of the reticle as or on very thin membranes. Unfortunately, such reticles are extremely delicate. Also, even with this technique, some temperature increase still occurs in irradiated subfields of the reticle, which results in unwanted thermal distortion. Although this distortion may at first consideration seem trivial, it can result in positional deviations of, for example, about 5 nm on the wafer, which is unacceptable for achieving modern levels of integration. For example, this level of positional deviation can result in significant misalignment of the pattern on the substrate, decrease in overlay precision between layers, and sub-optimal stitching together of subfield images on the substrate. These problems are manifest as reduced performance of the microelectronic devices that actually are produced.

In other words, the instant claims address the problem of preventing a segmented reticle, as used for CPB microlithography, from being distorted due to reticle heating by the illumination beam. To such end, "an object of the instant claims is to provide charged-particle-beam (CPB) microlithography methods and apparatus that suppress increases in reticle temperature caused by the CPB irradiation during exposure." (Specification, page 4, lines 25-27.) Neither this problem nor this object receives the slightest hint in Nakasaji and Suzuki. Since Nakasaji provide no hint whatsoever of this problem, Nakasaji inherently provides no teaching or suggestion of how to go

about solving such a problem, or whether any possible solution to the problem would work or would have any probability of success.

Rather, Nakasaji addresses the following objects: (a) in a CPB microlithography apparatus, providing a deflector having a greater deflector range (col. 3, lines 59-62); (b) providing a CPB microlithography apparatus that "can reduce transverse chromatic aberration regarding radial and azimuthal aberrations" (col. 4, lines 20-22); (c) providing a CPB microlithography apparatus in which both a condition regarding perpendicularity of an electron beam incident on a mask and a target and a condition for passing a main light path of the electron beam through the cross-over are satisfied simultaneously" (col. 4, lines 50-55); and (d) providing a CPB "transferring mask" and a CPB "transferring method, wherein a deflection amount of a charged particle beam passed through the mask can be reduced or the deflection of the charged particle beam can be eliminated " (Col. 4, lines 62-67.) To achieve these objects, Nakasaji discloses remedies such as: (a) providing, in association with a deflection coil, a correction coil that generates a correction magnetic field that corrects the deflection sensitivity of the deflection coil (col. 3, line 65 to col. 4, line 2); (b) configuring the deflection coil and correction coil to produce respective magnetic fields that extend in the same direction but are spaced apart (col. 4, lines 9-18); (c) displacing the center position of the first projection lens along the optical axis toward a crossover while displacing the center position of the second projection lens along the optical axis toward the crossover (col. 4, lines 34-40); (d) configuring the respective bore radii of the first and second projection lenses on the crossover side to be smaller than the bore radii on the other side (col. 4, lines 44-49); providing an angle-adjusting deflector that adjusts in incident angle of the beam as incident on the mask or substrate (col. 4, lines 59-61). Thus, the problems addressed by Nakasaji are unrelated to the problems addressed by the instant claims and have different solutions than those recited in the subject claims.

Furthermore, as admitted in the Office action on page 4 thereof, "Nakasaji does not disclose wherein the reticle includes multiple regions that are individually sequential[ly] transferred to the die . . . , each region on the reticle including one or more minor stripes illuminated multiple times by the illumination beam and transferred to the respective locations in the die on the substrate." In other words, Nakasaji fails to disclose the reticle including multiple regions that are individually and sequentially transferred to the die, wherein each region on the reticle includes one or more minor stripes that are illuminated multiple times such that the respective exposure units are illuminated multiple times by the illumination beam and transferred

to respective locations in the die on the substrate. (Applicant agrees with this failure of Nakasuji.) Since Nakasuji fails in this regard and provides no teaching or suggestion of the problem addressed by the subject claims, Nakasuji has substantial deficiencies with respect to the subject claims. Furthermore, the skilled person faced with the problem addressed by the instant claims would not consult Nakasuji because it has no useful information for solving the problem. In other words, the skilled person, armed with knowledge of Nakasuji, would receive no motivation from this reference to seek out Suzuki or to combine with Nakasuji anything disclosed in Suzuki to derive the subject claims. There is nothing in the primary reference, Nakasuji, that provides motivation to the skilled person to combine Suzuki with Nakasuji to derive the instant claims.

Furthermore, Suzuki does not fulfill the deficiencies of Nakasuji. The Office action points to an alleged disclosure in Suzuki, in which a mask-subfield pattern can be illuminated multiple times per die. Specifically, the Office action points to col. 6, lines 32-36 of Suzuki, which states, "If a mask-subfield pattern must be repeated many times in a die (as is the case when the die pattern is that of a memory chip) the mask-subfield pattern can be illuminated and projected multiple times per die, each time to a different transfer subfield on the wafer." (Emphasis added.) Note that, in Suzuki, none of the subfields is exposed multiple times to the same location (transfer subfield) on the wafer. In certain of the instant claims (see, e.g., claim 1), in contrast, each exposure unit defines a respective portion of the pattern that is transferred by a charged particle beam to a respective location in a die on a substrate, and respective exposure units are illuminated multiple times and transferred to their respective locations in the die on the substrate. In other claims (e.g., claims 12, 17, and 18), each of the minor stripes in a group are transferred in an ordered manner multiple times to respective minor stripes in the die. Suzuki does not teach or suggest making multiple exposures of individual exposure units or of individual minor stripes in a die, in the manner instantly claimed, because Suzuki is completely silent regarding any exposure problem that would require making such exposures.

Furthermore, in view of the lack in either reference of any hint of the problems addressed by the subject claims or of any solutions to such problems, the manner in which the Office action has picked and chosen individual features from each reference in an effort to reconstruct the combinations of elements in the subject claims has all the appearances of hindsight reconstruction, which is an improper basis for an obviousness rejection.

Furthermore, on page 4, last paragraph, of the Office action, the examiner in discussing Suzuki cites to "FIG. 14a", to "each die 310a", and to multiple rows of elements 304. These citations are incorrect. Suzuki has no FIG. 14a, and discloses no "die 310a" or elements 304.

In view of the foregoing, the discussion in the paragraph on the top of page 5 of the Office action lacks proper foundation and thus is immaterial.

Therefore, none of claims 1-2, 4-12, and 14-18 is obvious from either Nakasuji or Suzuki taken alone or from any conceivable combination of these two references. Withdrawal of the rejection is proper and hereby requested.

Claims 19-22 stand rejected for alleged obviousness from a combination of Muraki, Nakasuji, and Suzuki. This rejection is traversed.

Claim 19 incorporates the step of exposing a resist using the CPB microlithography apparatus of claim 17. In view of the many shortcomings of Nakasuji, either alone or in combination with Suzuki, as discussed above, this rejection simply cannot stand. Withdrawal of the rejection is proper and hereby requested.

Claim 20 incorporates the step of exposing a resist using the CPB microlithography apparatus of claim 18. In view of the many shortcomings of Nakasuji, either alone or in combination with Suzuki, as discussed above, this rejection simply cannot stand. Withdrawal of the rejection is proper and hereby requested.

The allowability of claims 19 and 20 renders claims 21 and 22 allowable without further discussion required.

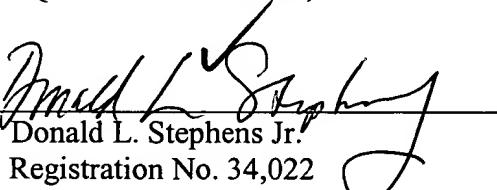
Applicant has a right to an interview at this stage of prosecution. If any issues remain unresolved after consideration of the contents of this paper, the examiner is requested to contact the undersigned to schedule a telephonic interview. Any inaction by the examiner to make such contact, followed by issuance of a final action, will be regarded as an acquiescence by the examiner to grant an interview as a matter of right after the final action.

Respectfully submitted,

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